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ECONOMIC EFFECTS OF TRADE POLICY ADJUSTMENTS IN THE WORLD MARKET FOR JAPONICA RICE

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ABSTRACT

World agricultural markets are entering another key period of policy adjustment as the Doha Development Agenda negotiation is being finalized. This paper investigates likely global market effects of expansion of access into the market in Japan and Korea and reduced subsidy for japonica rice in the United States. Using an equilibrium displacement model, we simulate changes in market prices, quantities and other aggregates in the presence of policy shocks. Results show that when U.S. subsidies decrease by 50 percent in addition to the full implementation of quota expansion in Korea and Japan, U.S. production decreases by more than 30 percent, and the U.S. is no longer an exporter. Instead, China increases its exports by 53 percent. The rest of the world increases exports by 14 percent and the world price rises by 0.7 percent. Changes in the Korean market are modest. Since Korea imports solely on the basis of its quota schedule, the Korean rice market is not connected to the world market, and these quotas remain relatively small compared to the size of the Korean market. The rice price in Korea decreases by 1.3 percent and production falls by 3.9 percent.

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I. Introduction

Global developments in the market for japonica rice are of growing interest in South Korea, just as developments in South Korea are of growing interest to market participants outside Korea. In 1995 Korea began to implement its World Trade Organization (WTO) commitments under the Uruguay Round. The amount of market access into Korea is currently about 200,000 metric tons-a quantity that is not insignificant in the relatively thin export market for japonica rice. Because of the Korean interest in the global market for japonica rice, this paper explores some important relationships in that market and considers the likely impacts of some potential policy adjustments.

About 400 million tons of rice are produced and consumed globally each year. About 60 percent of that is produced and consumed within India and China. Residents of Indonesia and Bangladesh produce and consume another 15 percent of global rice supply. Thus, 75 percent of world rice is grown and consumed in places where it evolved as the staple food. Given the relatively low incomes among the world's rice farmers, a significant proportion of world rice production is still consumed on the same farm where it is produced. The amount of rice that trades across national borders, currently about 25 million metric tons is only about six percent of world rice production.

Among the top eight rice-producing countries, japonica rice is produced in significant amounts only in China. Global japonica rice production is not known precisely, but we estimate global japonica output is between 50 million tons and 60 million tons per year. China is by far the largest producer and consumer of japonica rice supplying and using more than half the global total. Japonica production and consumption has been a growing share of rice supply in China for several years.

China maintained unilateral trade restrictions until joining the World trade Organization in 2003 and imports of japonica rice continue to be relatively restricted in such places as Japan, Taiwan and Korea, even by the standards of world agricultural trade. These facts have meant that the amount of japonica rice that trades in international markets is also a small share, about 5 to 6 percent, of the total world supply of japonica rice. These conditions reinforce the importance of Korea in the japonica market.

World agricultural markets are entering another key period of policy adjustment. The WTO framework agreement under the current Doha Development Agenda (DDA) negotiation, which was signed in August 2004, means that a plan for completing this round of negotiations is at hand (WTO, 2004). In the agriculture negotiations, detailed specifications of export subsidy, import access and domestic support commitments are being developed during 2005. When completed, these specifications will set the path for policy adjustments that are to be implemented over the following six to ten years starting perhaps in 2007.

This paper reviews the market and policy situation and outlook for japonica rice on a global basis. We describe briefly the most important current policies that affect international trade in japonica rice. We also examine some alternative policy scenarios that reflect potential outcomes of the DDA and the negotiations for additional access that Korea recently completed with its trading partners. In particular, we consider likely global market effects of expansion of access into the market in Japan and reduced subsidy for japonica rice (among other crops) in the United States.

II. The Global Policy Situation on Japonica Rice Trade

Now that China and Taiwan are members of the World Trade Organization, policies of all the major participants in the market for japonica rice are governed by WTO agreements and rules. Thus this brief review of global rice policy may be placed in the context of WTO agreements and negotiations.

With the end of the 10-year period since the WTO was formed, 2005 marks the first year in which Uruguay round import commitments have been fully implemented. In 2004 Japan was committed to provide access for about 0.68 million metric tons under a "low" tariff. Japan applies a prohibitively high tariff to any potential imports above this quantity. Japan imports from a variety of sources, but traditionally has imported almost half of its total from California. South Korea was committed to provide access for import about 0.2 million metric tons under its rice quota. Korea has also imported from a variety of sources in recent years including from the United States and China. Little, if any, imported rice has entered the normal marketing channels for table rice in either Japan or Korea.

Under their accession agreements for membership in the WTO, China and Taiwan provided TRQ access to their domestic markets and agreed that some portion of the potential imports would be handled outside the state trading enterprise system. As a part of its accession commitment scheduled imports by Taiwan, as set by its WTO accession agreement, are about 127 million metric tons. Even though the percentage rate of import is higher than Korea and Japan, this total is very small relative to Japan or Korean imports or to exports from the United States or Australia. The access agreement for China included separate commitments for japonica rice in the form of a tariff rate quota, but the quantities specified have not been binding and are not expected to be binding over the next several years.

III. The Global Policy Outlook: the DDA round of WTO negotiations

In 2005, the global WTO negotiations, the Doha Development Agenda (DDA), continue with renewed thrust, given the "framework agreement" signed in August in Geneva and subsequent affirmations of the major negotiating countries and coalitions (WTO, 2004). That agreement and the negotiating positions of each WTO member have set parameters and expectations for an agreement on modalities that is scheduled to be complete at the December 2005 ministerial meeting in Hong Kong (WTO, 2005a). The period since August has been spent on technical issues such as converting specific tariffs into ad valorem equivalents. The other major issues have been building political consensus for substantial subsidy and trade barrier reductions across all commodities. The emergence of the G20 coalition (including Brazil, China, and India, and others) as a force for market opening and subsidy reduction has encouraged more rather than less ambition for the agricultural negotiations.

1. Trade Policies:

The framework promises gradual elimination of subsidies on commercial exports, including indirect export subsidies associated with export credit guarantees, state trading enterprises and food aid. On import access, the DDA framework schedules a less complete liberalization. These agreements and the current negotiating positions of important negotiating coalitions suggest that the highest tariff rates will be reduced most with the highest bound tariff rates declining by 50 percent or more (a so-called tiered approach). The reductions of tariff rates will be applied in "bands" rather than as a single formula. Tariff rate quota (TRQ) quantities will also be expanded. Doubling of small access quantities under TRQs may be likely outcomes. The access negotiations have yet to specify the reduction rates and which products belong in which reduction tiers.

Smaller tariff cuts and slower expansion of the quota quantities for tariff rate quotas will be allowed for sensitive products. Each country will be allowed to declare a limited number of sensitive products, but these will not be exempted from access improvements. The market access expansion in developing countries is likely to be limited for many commodities. Smaller increases in access will be required for developing countries under the special and differential treatment provisions. Developing countries will also be allowed to declare a limited number of special products for which less access improvement will be required. Japonica rice will almost surely be proposed for the "sensitive" or "special" categories by some countries, but others will urge as much market opening as possible.

2. Domestic Support Programs:

Finally, as expected, debate over domestic support programs has raised many issues and proposals and the suggested schemes to deal with these programs are almost as complex as the programs themselves. The bottom line is likely to be some tightening of what payments can be considered exempt from reform (green box) and some allowance for programs that are more than minimally trade distorting yet do not contribute to production as much as full production subsidies (blue box). With those changes, there will likely be limits on overall subsidies in the less distorting category (blue box) and substantial cuts in the category of subsidies that are considered most trade distorting (amber box). Progress on the details of this reform plan is likely to come throughout 2005, with a basic agreement on many specifics by the end of the year and a final deal in 2006.

The access barriers among the major importers limit imports quantitatively and mean that domestic subsidy programs in those countries have little if any effect on international trade. That is, in both Japan and Korea, domestic support provided to the rice industry may affect domestic production, domestic price, farm income or other variables in the domestic economy, but these programs do not affect the amount of rice imported and thus do not affect the world market. This will be true so long as the import quotas remain binding.

Among significant exporters of japonica rice, China, Australia and Egypt have no significant domestic subsidies for rice. However, the United States does have major subsidies for rice that are similar to those for other major field crops such as cotton, corn, barley, sorghum, wheat and soybeans. The United States does not provide significant production subsidy for fruits, tree nuts, vegetables, seed crops, wild rice, irrigated pasture or hay. This is important because these are significant alternative crops in the japonica rice-growing region of California.

The negotiations and the settlement of the recent WTO dispute over cotton together imply that substantial reductions in trade distorting subsidies will result from the negotiations (WTO, 2005b). The negotiating positions suggest that cuts in the aggregate measure of support by 50 percent or more are likely. In addition, there will be shift of some subsidy programs into less production distorting forms. For japonica rice the subsidy reductions in the United States are particularly important.

The U.S. subsidy programs are complex and include a number of features that were renewed and adjusted in 2002 (Sumner, 2003). The outlays on the rice subsidy vary inversely with market prices from year to year. Average outlays on major payment programs for rice (currently the direct payment program, the counter-cyclical payment program and the marketing loan program) have been roughly equal to market revenues. In low-price years, revenue from government support has exceeded market revenue by a substantial margin. In high-price years, the market revenue exceeds government payments on the rice program.

A significant share of the payments made under the various rice programs is tied to rice production only indirectly and provides limited incentives for rice production. However, limitations on what is planted on rice land to maintain eligibility, updating of the base used for payments, and risk and liquidity considerations mean that even partially "decoupled" payments have production effects. The recent WTO dispute over the U.S. cotton program may be relevant to how these programs are evaluated. The panel ruling on the cotton case suggests that these programs cannot be considered "minimally" trade distorting and may not be considered "not product specific." Nonetheless, there is no question that the direct payments and counter-cyclical payments provide less incentive for rice production than would a rice-specific production subsidy or than that the marketing loan program does, especially in crop years when the international market price is expected to be relatively low. For the part of U.S. subsidies that are tied to rice production more loosely, the negotiations (and WTO ruling in the cotton dispute) are likely to imply some adjustments, even though production impacts may be smaller than the marketing loan programs that are tied directly to rice production and price.

However, the bottom line is that the U.S. rice program, especially the marketing loan program, does stimulate rice production. Therefore, if the program was removed or reformed the United States would produce less japonica rice. Since japonica rice has very high levels of protection in several countries and very high rates of subsidy in the United States, Japan and Europe, these WTO-induced subsidy changes are likely to imply significant effects on production and trade.

IV. Analysis of Potential Policy Adjustments in Japonica Rice

We next consider some potential adjustments in global rice policy that move the market in the direction of lower subsidies and additional market access over the next decade. In order to simulate impacts of these policy adjustments we develop a model and implement that model using baseline projections for the "constant policy" scenario. We then compare outcomes under alternative potential policies.

1. A Simulation Model Applicable to Policy Adjustments in Japonica Rice

To represent the essential features of world japonica markets, while keeping the model simple, each country or group of countries trading japonica rice in the world market is set as either a net importer or net exporter. For each market participant, input and output markets are specified with a series of supply and demand functions, and then the market adjustments in response to the introduction of an alternative policy are described. In modeling these adjustments, we use a partial equilibrium displacement model specified in log linear form. The basic framework is due to Muth (1964). Subsequent elaborations to multiple input and output markets are found in Sumner et al. (1999), Alston et al. (1995), Gardner (1990), and Hertel (1991).

In the context of world japonica rice, trade liberalization mainly centers on relaxing restrictive border policies of some major importers. The policy instruments used to represent trade liberalization for japonica rice include minimum access quotas for rice and ad valorem tariffs on imported rice. We assume there are no major relevant border measures in the exporting countries. However, our model allows the possibility of domestic subsidies for rice production for exporters.

We use the following notational convention. Superscript i denotes an importer or exporter and w represents the world. There are I number of countries or groups of countries. Of these, there are iq number of net importers and (I- i_q) net exporters. These importers are differentiated into those, i=1,... i_t, that impose tariffs on imported rice, and the rest, i=i_t+1,..., i_q, that import rice according to the binding quotas. (Note that any importers that do not restrict imports are included in the tariff group with a zero tariff.) In the context of a single output, rice, we consider three inputs−labor, material input, and land−denoted as L, M, and K, respectively.

The basic structure of the model is given in equations (1) ~ (10).

1) $$D^i = f^i(p^i; \boldsymbol{z_D^i}) \quad \forall i = 1,..., I$$

2) $$p^i + \mu^i = \frac{\partial C^i(\boldsymbol{w^i}, Y^i)}{\partial Y^i} \quad \forall i =,..., I$$

3) $$x_j^i = \frac{\partial C^i(\boldsymbol{w^i}, Y^i)}{\partial w_j^i} \quad \forall i = 1,..., I, \, and \;\; j = L, M, K$$

4) $$w_L^i = h^i(x_L^i; \boldsymbol{z_L^i}) \quad \forall i = 1,..., I$$

5) $$w_K^i = h^i(x_K^i; \boldsymbol{z_K^i}) \quad \forall i = 1,..., I$$

6) $$Y^i + IM^i - EX^i = D^i \quad \forall i = 1,..., I$$

7) $$p^i = p^w(1+\tau^i), \quad \forall i = 1,..., i_t$$

8) $IM^i = Q^i, \quad \forall i = i_t + 1, ..., i_q$

9) $p^i = p^w, \quad \forall i = i_q + 1, ..., I$

10) $\sum_i IM^i = \sum_i EX^i$

Equation (1) represents domestic consumer demand for rice, where D^i is the demand for rice in country i, p^i is the domestic price for rice, and is a vector of exogenous variables. Equation (2) determines the level of rice production in country i by equating the marginal cost to the farmers' effective price under the assumption of perfect competition. The effective price is the sum of the domestic price and effective per unit subsidy rate, μ^i.[1] The total cost is a function of a vector of input prices, $\mathbf{w}^i$, and the level of output, Y^i. Equation (3) represents derived input demand where x_j^i is the derived demand for input j that is devoted to rice production in country i. Equations (4) and (5) represent the supply sides of labor and land inputs in country i, with $\mathbf{z}_L^i$ and $\mathbf{z}_K^i$ denoting the vectors of shifting factors for the supply of labor and land, respectively. The supply function for material input is simply given by its exogenous price, guided by an economic principle that, over an intermediate or long time horizon, changes in quasi-rent are captured by labor and land, not material input, which is supplied elastically to a single agricultural industry. This is particularly true in the case of a partial equilibrium model and under the relatively competitive input markets.

Equation (6) represents the equilibrium condition in the domestic rice market, where domestic demand for rice equals total domestic production of rice plus net imports, IM^i, minus net

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1 This formulation of effective price in equation (2) intends to describe the policy of a county such as the United States, where substantial domestic subsidies are provided to rice farmers. Under such a situation, the farmers do not equate their marginal cost to the price, but to their effective price, in this case, the sum of the market price and the per unit subsidy (when no subsidies are provided, μ^i equals zero).

exports, EX^i. Since we employ the net amount for each county's trade figure, either IM^i or EX^i is zero for each i. Equation (7) determines the domestic price of rice for the rice importing countries under the tariff policy, where p^w is the world price and τ^i is the ad valorem tariff on imported rice. Equation (8) applies to the countries that import rice under a binding quota, and defines imports for those countries. Equation (9) defines the domestic rice price for the exporting countries. In these countries, no trade distortion means that the domestic price facing consumers equals the world price.[2] Finally, equation (10) represents the equilibrium condition for the world market, that is, the total rice export equals the total rice import.

Totally differentiating equations (1)-(10) and using log differentials to convert to elasticity form yields the following linear elasticity model. With the exception of the carets that denote proportional changes, all notation in equations (1) through equation (10) applies to equations (1') through (10').

1′) $$\hat{D}^i = \eta^i \hat{p}^i + \sum_j \lambda_j^i \hat{z}_j^i$$

2′) $$a_p^i \hat{p}^i + a_\mu^i \mu^i = \sum_{n=L,M,K} v_n^i \hat{w}_n^i$$

3′) $$\hat{x}_j^i = \sum_{n=L,M,K} v_n^i \sigma_{jn}^i \hat{w}_n^i + \hat{Y}^i, \quad j = L, M, K$$

4′) $$\hat{w}_L^i = \rho_L^i \hat{x}_L^i + \sum_j \varepsilon_{Lj}^i \hat{z}_j^i$$

5′) $$\hat{w}_K^i = \rho_K^i \hat{x}_K^i + \sum_j \varepsilon_{Kj}^i \hat{z}_j^i$$

6′) $$\hat{D}^i = b_Y^i \hat{Y}^i + b_{IM}^i \hat{IM}^i - b_{EX}^i \hat{EX}^i$$

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2 With zero tariff, equation (9) is a special case of equation (7), and can be collapsed into equation (7). However, we separated price equation (7) and equation (9), for clarity.

7′) $\hat{p}^i = \hat{p}^w + \hat{\omega}^i \quad \forall i = 1,...,i_t$

8′) $I\hat{M}^i = \hat{Q}^i \quad \forall i = i_t+1,...,i_q$

9′) $\hat{p}^i = \hat{p}^w, \quad \forall i = i_q+1,...,I$

10′) $\sum_i g^i I\hat{M}^i = \sum_i h^i E\hat{X}^i$

Throughout the equations (1')-(10'), the following notation is used; η^i and λ^i_j are country i's demand elasticities with respect to the own price and each of demand shifting variables; a^i_P and a^i_μ are the shares of the market price and subsidy in the effective price ($p^i+\mu^i$); v^i_n is the cost share of input n; σ^i_{jn} is the Allen elasticity of substitution between inputs j and n; ε^i_{Lj} (ε^i_{Kj}) and ρ^i_L (ρ^i_K) are the elasticities representing the changes in the wage (land rental rates) with respect to each of shifting factors and own quantity; b^i_Y, b^i_{IM}, and b^i_{EX} are the shares of domestic production, net imports, and net exports, respectively, in country i's domestic consumption of rice. That is, for the net importing countries, the sum of b^i_Y and b^i_{IM} is one (with b^i_{EX}=0) and for the net exporting countries, the sum of b^i_Y and $-b^i_{EX}$ (with b^i_{IM}=0) is one; $\omega^i=1+\tau^i$; g^i and h^i are the *i*-th country's import and export shares in the world market.

2. Empirical Implementation

In our implementation of the model just outlined, the world japonica rice market consists of six units. China, the United States, and an aggregate of the rest of the world exporters, ROWX, are net exporters. Korea, Japan and an aggregate of the rest of the world importers, ROWI, are net importers. Each of the ROWs is a composite of countries. Note that even though Taiwan is an all-japonica producer and consumer, it is not considered as a separate player in our model. Taiwan produces and consumes about one million metric tons of rice (all japonica). This total is about one eighth that of Japan, one fifth that of Korea, and about one-half the amount of japonica production of the United States. Taiwan is also a much smaller producer of rice than is Egypt, which is a significant exporter of japonica rice. Because Taiwan is such a small factor in the global market for japonica rice, it is reasonable to include Taiwan in the model of japonica rice markets only in the aggregate of all other importing countries along with Turkey, Jordan and others, rather than to include Taiwan separately.

To calibrate the above model, we must specify the values of the parameters in the model. The parameters include various elasticities and shares in the base period. In our policy simulation, we use two base periods, 2009 and 2014, that represent the middle and end periods of the 10-year policy implementation period. The projections to 2009 and 2014 are based on the FAPRI preliminary baseline for 2005.[3] However, FAPRI does not provide figures for japonica rice separately. Thus, in countries and groups of countries that produce both japonica and other rice, we adjust for various japonica shares to arrive at the numbers presented in table 1. For example, we use California values for japonica rice in the United States and use detailed data from various sources to project the japonica production and exports from China. Factor shares are constructed using 2002 data under the assumption that the same factor shares prevail in the future.[4]

In assigning the elasticity values, we relied on previous empirical investigations and when previous studies are not available, we relied on our interpretations on the most relevant empirical evidence. In the specification of own Marshallian price elasticities of rice demand in equation (1’), one consideration important is the substitution possibility in consumption between japonica and indica

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3 Source: http://www.fapri.missouri.edu/BaselineReview2004

4 Data for Korea and the U.S. show that factor shares are relatively constant over the last decade.

rice. A higher substitution possibility implies a greater demand response to a price change in the japonica rice market. This implies that the price elasticities are less elastic for Korea and Japan where little substitution between japonica and indica rice exists than those for the rest of the countries. Guided by this, we specified the own demand elasticities to be -0.7 for China, -0.2 for Korea, -0.2 for Japan, -0.5 for the United States, -0.6 for ROWI, and -0.6 for ROWX.

The model also requires estimates for the Allen elasticities of input substitution. These are not available from the econometric literature. In the base simulation, they are all set equal to one. Finally, we need to specify the supply elasticities for labor and land. Our partial equilibrium model implies a relatively elastic input supply curves facing individual crop industries. On the other hand, there exists considerable fixity in agricultural labor and land inputs, perhaps especially for rice in Korea. Assuming that such

TABLE 1. Baseline Quantities and Parameters Used in Simulation

A. Baseline Quantities for 2009 and 2014

	China	Korea	Japan	US	ROWX	ROWI
ratios used in converting rough rice to milled rice	0.6	0.7	0.7	0.7	0.65	0.65
YEAR 2009						
(Million metric tons in milled rice)						
Production (Y)	32.82	4.66	7.50	1.40	5.00	
Consumption (C)	31.02	4.86	8.00	0.94	4.10	
Exports (EX)	1.80	0.00	0.00	0.46	0.90	
Imports (IM)	0.00	0.20	0.50	0.00	0.00	2.46
YEAR 2014						
(Million metric tons)						
Production (Y)	32.82	4.66	7.20	1.50	5.50	
Consumption (C)	31.02	4.86	7.70	1.04	4.40	
Exports (EX)	1.80	0.00	0.00	0.46	1.10	
Imports (IM)	0.00	0.20	0.50	0.00	0.00	2.66

Source: see appendix

B. Parameter specification

	China	Korea	Japan	US	ROWX	ROWI
Own output demand elasticity (2009 and 2014)	-0.7	-0.2	-0.2	-0.5	-0.6	-0.6
Various shares (Consumption based shares and world market shares)						
Year 2009						
Shares based on domestic consumption						
Domestic production (Y/C)	1.06	0.96	0.94	1.49	1.22	0.43
Export (EX/C)	0.06	0.00	0.00	0.49	0.22	0.00
Imports (IM/C)	0.00	0.04	0.06	0.00	0.00	0.57
Shares in the world market						
Imports	0.00	0.06	0.16	0.00	0.00	0.78
Exports	0.57	0.00	0.00	0.15	0.28	0.00
Year 2014						
Shares based on domestic consumption						
Domestic production (Y/C)	1.06	0.96	0.94	1.44	1.25	0.43
Export (EX/C)	0.06	0.00	0.00	0.44	0.25	0.00
Imports (IM/C)	0.00	0.04	0.06	0.00	0.00	0.57
Share in the world market						
Imports	0.00	0.06	0.15	0.00	0.00	0.79
Exports	0.54	0.00	0.00	0.14	0.33	0.00
Elasticities of input substitution (2009 and 2014)						
Labor/material	1.0	1.0	1.0	1.0	1.0	1.0
Labor/land	1.0	1.0	1.0	1.0	1.0	1.0
Material/land	1.0	1.0	1.0	1.0	1.0	1.0
Factor expenditure shares (2009 and 2014)						
L (labor)	0.43	0.21	0.31	0.11	0.30	0.30
M (material)	0.43	0.33	0.55	0.65	0.40	0.40
K (land)	0.14	0.46	0.14	0.24	0.30	0.30
Input supply elasticity (inverse) (2009 and 2014)	0.6	0.6	0.6	0.4	0.6	0.6
Policy parameters(2009 and 2014)						
Rate of income subsidy	0	0	0	0.25	0	0

Note: for additional information on parameter construction, see appendix.

fixity increases with a larger share of agricultural population in the country, the elasticities related to inputs are specified as 0.6 for China, Korea, ROWI and ROWX, and 0.4 for the US. Considering these two opposite aspects, we assigned a moderate value, 0.5. (Note that our elasticity (or flexibility) measure is the relative change in price with respect to a change in quantity, inverse of usual own price elasticity of supply.)

Along with trade policy, another policy consideration in the model is domestic rice income subsidies, represented by μ in (2'). Of the three exporters, the Unite States is the only country that provides a substantial level of production subsidy for japonica rice in a way that affects trade. (Subsidies in Korea and Japan do not affect imports, because those are set by binding quotas.) That is, a_μ's are zero (i.e., a_p=1) for all countries except for the United States. On average, government transfer payments represent about 40 percent of the U.S. rice farmers' revenue. However, given that a substantial portion of these payments is not tied directly to current rice production, we adopt 0.25 for the value of a_μ for the United States.

V. Policy Scenarios and Simulation Results

In light of our discussion on the earlier global policy section, three policy scenarios are considered:

(1) Rice import quota for Korea increases from 2004 levels by 50 percent in 2009 and 100 percent in 2014.

(2) Rice import quotas for both Korea and Japan increase from 2004 levels by 50 percent in 2009 and by 100 percent in 2014.

(3) Rice import quotas for both Korea and Japan increase by 50 percent in 2009 and by 100 percent in 2014 and U.S. domestic subsidies for japonica rice decreases by 25 percent in 2009 and 50 percent in 2014.

We did not consider any tariffication scenario. Japan imports conform to its quota quantity with a prohibitive tariff on the quantity over the minimum access. These tariffs are set so high that actual imports are determined only at the quota access quantity. This means that for both Korea and Japan, their import restrictions are represented by equation (8’) alone in our model. Table 2 presents our simulation results for all three policy scenarios for 2009 and 2014 as specified above. Our results indicate very small effects in the world as well as in Korean markets under the scenario (1). Korea is expected to import additional 0.2 million tons by 2014. This quantity represents about 7 percent of japonica rice traded in the world market. The world price increases only by 0.1percent due to this additional import. This indicates that the world japonica rice market is relatively price elastic in the long run when we allow land and labor markets to adjust.

TABLE 2. Simulation Results

	China	Korea	Japan	US	ROWI	ROWX
2009						
Quota for Korea goes up by 50%						
Consumption	-0.04%	0.10%	0	-0.03%	-0.03%	-0.03%
Domestic price	0.05%	-0.7%	0	0.05%	0.05%	0.05%
Production	0.2%	-1.9%	0	0.4%	0.2%	0.2%
Imports	–	50%	0	–	-0.2%	–
Exports	4.1%	–	–	1.2%	–	1.2%
Quotas for Korea and Japan go up by 50%						
Consumption	-0.1%	0.1%	0.1%	-0.1%	-0.1%	-0.1%
Domestic price	0.2%	-0.7%	-0.6%	0.2%	0.2%	0.2%
Production	0.7%	-1.9%	-3.1%	1.3%	0.7%	0.7%
Imports	–	50%	50%	–	-0.7%	–
Exports	15.1%	–	–	4.2%	–	4.3%
Quotas for Korea and Japan go up by 50% and US subsidies decrease by 25%						
Consumption	-0.3%	0.1%	0.1%	-0.02%	-0.3%	-0.3%
Domestic price	0.5%	-0.7%	-0.6%	0.5%	0.5%	0.5%
Production	1.8%	-1.9%	-3.1%	-32.7%	1.7%	1.7%
Imports	–	50%	50%	–	-1.8%	–
Exports	37.6%	–	–	-100%	–	10.7%

	China	Korea	Japan	US	ROWI	ROWX
2014						
Quotas for Korea goes up by 100%						
Consumption	-0.08%	0.3%	0	-0.06%	-0.07%	-0.07%
Domestic price	0.1%	-1.3%	0	0.1%	0.1%	0.1%
Production	0.4%	-3.9%	0	0.7%	0.4%	0.4%
Imports	–	100%	0	–	-0.4%	–
Exports	8.5%	–	–	2.6%	–	2.2%
Quotas for Korea and Japan go up by 100%						
Consumption	-0.3%	0.3%	0.2%	-0.2%	-0.2%	-0.2%
Domestic price	0.4%	-1.3%	-1.2%	0.4%	0.4%	0.4%
Production	1.4%	-3.9%	-6.1%	2.6%	1.3%	1.3%
Imports	–	100%	100%	–	-1.4%	–
Exports	29.8%	–	–	9.0%	–	7.6%
Quotas for Korea and Japan go up by 100% and US subsidies decrease by 50%						
Consumption	-0.5%	0.3%	0.2%	-0.3%	-0.4%	-0.4%
Domestic price	0.7%	-1.3%	-1.2%	0.7%	0.7%	0.7%
Production	2.5%	-3.9%	-6.1%	-30.5%	2.4%	2.4%
Imports	–	100%	100%	–	-2.5%	–
Exports	52.7%	–	–	-100%	–	13.5%

In scenario (2), when Korea and Japan both increase their quota amounts (for Japan, the increase in quota in 2014 amounts to additional 0.5 million tons), the world price increases by 0.4 percent. Of the importing countries, China increases its exports most, by 30 percent in 2014.

The largest impact on the world market is realized under the third scenario. When U.S. subsidies decrease by 50 percent in addition to the full implementation of quotas in Korea and Japan, U.S. production decreases by more than 30 percent, and the US is no longer an exporter. Instead, China increases its exports by 53 percent and ROWI increases exports by 14 percent. The world price remains relatively stable with price rising by 0.7 percent.

Under all scenarios, the Korean market changes little. Since

Korea imports solely on the basis of its quota schedule, the Korean markets are not connected to world price movements during this period. That is also true for Japan. Further, these quota amounts remains small enough relative to the size of the Korean market such that any long run price effects are moderate. The rice price in Korea decreases by at most 1.3 percent and production decreases by a maximum of 3.9 percent.

VI. Conclusions

Market variables change due to a variety of reasons. In this paper, we investigate the market changes due to potential policy changes in Korean and world japonica rice markets. It is important to remember that our simulation results represent the market effects due only to potential policy changes, holding all other conditions constant. That is, our results should be interpreted solely as policy effects. Of course, other exogenous variables that affect the rice markets are not included directly in our simulations. We know that many market events, including weather and other supply shocks will affect rice supply, demand and price over the next decade.

In Korea, per capita consumption of rice has been decreasing for many years. As income increases, urbanization continues and diets change, Koreans have consumed less staple grain and a larger variety of products. Such an income-induced contraction of domestic rice consumption may cause a decline in domestic price of rice in Korea if policy maintains supply and does not control the market price. Our simulations indicate the modest increases in imports do not themselves imply large declines in market price.

In a more comprehensive model of japonica rice it may be of interest to model Egypt and Australia separately on the export side and perhaps Taiwan and a few others separately on the import side. Such disaggregation would provide further detail, but would not change results for the aggregates or for the major countries that we treat separately.

Appendix

Baseline and parameter construction

The major data difficulty associated with a study examining japonica rice arises with the fact that separate data for japonica rice are not available. This implies that japonica rice data have to be inferred using secondary information when they are not directly available. This is the case in our study, with the data for those countries such as China, ROWI, and ROWX that consume and produce both japonica and indica rice.

Our baseline data are constructed based on information from three sources:

1) Food and Agricultural Policy Research Institute (FAPRI), http://www.fapri.missouri.edu/BaselineReview2004
2) International Rice Research Institute (IRRI), Rice statistics http://www.irri.org/science/ricestat/index.asp
3) U.S. Department of Agriculture, Economic Research Service (USDA/ERS) Rice Yearbook 2003, http://www.ers.usda.gov/publications/so/view.asp?f=field/rcs-bby

FAPRI projection includes data on area harvested, production, consumption, beginning and ending stock, and net trade on world rice by country for the next ten years. However, its projection does not differentiate japonica and indica rice. Thus, when FAPRI data are not appropriate for our use, we either adjust the data using additional information available or rely on different sources. When projected data are not available, in constructing baseline data, our best "guesses" are in many cases based on information on the most current situation, implying that in the absence of information about the future, we consider the current situation contains most information about the future. This means that we also need current benchmark data. For these, we relied on two sources, rice statistics from IRRI and USDA.

The following describes the process of our baseline data construction in more detail.

China:

China produces and consumes both japonica and indica rice. China also trades both variety of rice, mainly exports japonica rice and imports indica rice. Given this situation, FAPRI projection was not usable for our purposes. Thus, we first constructed the benchmark data using 2002 rice statistics published from IRRI under the following assumptions: 1) We assumer that 30 percent of Chinese rice production is japonica. (This is based on Hansen et al. (2002) that states that japonica production was estimated at 29 percent of total rice production in 2000.) 2) We assume 90 percent of China's exports are japonica rice.
Once japonica production and export data are constructed using these assumptions, we arrived at japonica consumption by subtracting exports from production. Once benchmark data were created, we projected baseline data under the assumption that the 2002 condition continues through 2014 (this was also consistent with FAPRI projection on total rice production and consumption).

Japan

Japanese benchmark data were obtained from IRRI rice statistics. According to IRRI statistics, in 2002, Japan produced 11.10 million tons (rough rice) and imported 0.5 tons (milled) in net. From these figures, to obtain 2009 and 2014 baseline figures, we assumed that production decreases by 0.5 percent each year (which is consistent with the data in the past) while imports remaining constant. Consumption data are obtained by adding net imports to production.

The United States:

Given the fact that japonica rice is produced only in California, to arrive at US japonica data, we separated out only California rice data from the rice data published in USDA's rice yearbook. We first constructed our benchmark 2002 data. Production data was readily available, but US export of Japonica data were not because US export data do not specify the origin (regions in the

U.S.). However, industry analysts in California estimate one third of California production is shipped to export markets in recent years. Thus, based on this information, we assume that U.S. japonica exports are one third of California production. From the benchmark figures, we assumed 1 percent yield growth to expand 2002 production into 2009 and 2014 figures. Export shares remain the same.

Korea

Even though FAPRI baseline projection was available for Korea, we chose not to use FAPRI projection because projected production for Korea was consistently substantially greater than consumption, implying Korea accumulates large stock each year. We did not think this was a likely scenario and we instead assumed that current situation prevails in the future. The current benchmark data was obtained from KREI.

Rest of the world, exporting countries (ROWX)

The major japonica export countries in the world market include the U.S., China, Australia, and Egypt. Given the U.S. and China are considered as separate counties in our model, ROWX mainly includes Australia and Egypt. We assumed that Egyptian rice production is all japonica and thus its exports are all japonica. However, Australian rice production is only 80 percent japonica (based on xx), but its exports are all japonica. FAPRI projections are: 4.3 (4.8) and 0.6 (0.6) thousand tons of production and exports in 2009 (2014) for Egypt, and 0.7 (0.9) and 0.3 (0.5) thousand tons of production and exports in 2009 (2014) for Australia. Based on these figures, we arrived at 5 (5.5) thousand tons of ROW exports in 2009 (2014). Consumption data are calculated by subtracting exports from production.

Rest of the world, importing countries (ROWI)

Unlike japonica exporting countries, ROWI is represented by many countries, and it is difficult to identify ROWI with individual countries. Even though there are some important importers such as Japan, Korea, Turkey and Jordan, they account for less than half of the world market share.

Trade data for ROWI are calculated using the notion of equilibrium, meaning that total world exports equal total world imports. Therefore, the ROWI import is calculated as the sum of all (world) exports minus the sum of the imports of Japan and Korea. However, domestic production and consumption require country data that are not readily available. Thus, instead of constructing production and consumption data for ROWI, we constructed share parameters (ratios of domestic production to consumption and imports to consumption) using Turkey as a representative country. We relied on FAPRI for Turkish data.

Input data

We calculated input shares, using the most recent input data, and we assume that these input shares remain the same in the future. Information sources are MAF (2004) for Korea and Japan, and CCAP for China (survey data which were used in the study comparing the costs of rice production), and USDA (Livezey and Foreman) for California. For the input shares for ROWX and ROWI, we used the averages of China, Korea, Japan, and the U.S.

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